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Calculus for Business

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OVERVIEW

Calculus studies how varying one quantity has an effect on a related quantity. Traditionally, business programs in university place a strong emphasis on interpersonal skills of leadership and networking at the expense of analytical reasoning. But in order to succeed in an increasingly more competitive and interconnected world, the business leaders of tomorrow should be well-equipped to communicate meaningfully with economists, engineers and data scientists.

The purpose of this course is to take the formal techniques of differentiation and integration and apply these to make meaningful inferences and predictions from quantities of interest. In this way, students will develop a more quantitative understanding of cost, demand and capital to better inform their decision-making process in relation to business.

COURSE OBJECTIVES

By the end of the course you should be able to

1. Apply the mathematical techniques of differentiation and integration to concrete business scenarios
2. Identify the quantities of interest -- cost, demand, supply, revenue and capital -- for a variety of situations informed by industry and consumer behavior
3. Translate between the terminology of mathematical abstractions and the concepts employed by business and management cultures
4. Persuasively argue in favor of establishing strong ties of collaboration between academia and the private sector
5. Demonstrate sensibility to the undeniable impact that organized human activity has on the environment and ensure that your involvement in business aims towards sustainability

COURSE OUTLINE

Each unit is expected to cover a month of the term.

Unit 1 -- Cost and Production

The cost function is introduced as the starting point for quantitative economic analysis. We'll study how marginal cost describes the rate of change of cost, while recognizing that the usefulness of our models depends crucially on the data used.

Unit 2 -- Demand and Revenue

The demand function is introduced as the main tool for establishing the price for a commodity. By applying the technique of optimization, it is shown that it is possible to make a prediction for what choice of price will be most profitable. Ethical considerations of sustainability and the environment are first considered in this unit as well.

Unit 3 -- Supply and Consumer Behavior

This unit explores the quantitative relation between supply and demand, and the role that marketing research plays in obtaining models for how consumers will respond to new products, as well as advertising and branding campaigns.

Unit 4 -- Capital and Investment

Finance is the branch of business that is most explicitly quantitative. This unit will study the appraisal of assets, the role of interest in banking and how capital and potential revenue are assessed by investors before establishing new companies. We'll conclude the course by examining the relevance that thermodynamics has in finance, and how this gives meaningful arguments in favor of sustainability.

WHAT TO EXPECT FROM LECTURES

Lectures begin by introducing key concepts from the IB curriculum for business management and place these ideas in the context of contemporary companies from both Canada and the rest of the world. Having thus motivated the concepts of each lecture, these are then related back to the quantities of interest. The techniques of calculus will be employed in examples to demonstrate the utility of quantitative analysis.

GRADE DISTRIBUTION

Pre-Readings and Participation -- 10%

Prior to each lecture, students are expected to complete a brief reading assignment introducing the concepts for each lecture, as well as demonstrating the mathematical techniques in class. The lectures will closely follow the readings, and students that have done the readings will be better equipped to ask questions on what ideas they need clarification on.

Homework -- 20%

There will be 7 homework assignments in the course, to be completed biweekly. On average, each assignment will consist of 5 problems and students should be able to start work on the problems the day they receive the assignment. Collaboration between students is encouraged and students are also welcome to contact the instructor, but the answers handed in each completed assignment are expected to be their original work.

Midterm Exam -- 20%

The midterm exam will take place at the end of the second unit and will involve a mix of qualitative conceptual questions and quantitative computational problems. As an encouragement to do the homework, 1 problem in the midterm will be identical to one of the homework problems.

Final Exam -- 50%

The final exam takes place at the end of the term and is cumulative. In addition to conceptual and computational problems, the students will write a short persuasive essay in a consultant-style case study. This gives students an opportunity to use their qualitative and quantitative reasoning skills in relation to a real-world scenario. As in the case with the midterm, 1 problem from the final will be identical to one of the homework problems.